

approach

JUNE 1983 THE NAVAL AVIATION SAFETY REVIEW

In this issue:
★ Lightning and Naval Aviation
★ Elmo, Patron Saint of Night
★ Weight and Balance Features

The
Crash
Crews

THE UNIVERSITY
OF MICHIGAN

JUN 28 1983

ENGINEERING
LIBRARY

Like a Vertical Glacier

It must have been excruciating. The agonizingly slow shriek of rending metal.

Picture a snow-covered naval air station last winter. An E-7 aircrewman was in the process of hangaring a C-130. In doing this, he sequentially opened first one, then two 76,000-pound electrically-driven hangar bay doors. When he saw that the huge doors had moved to the desired position, he took his hand off the button, turned around and meticulously supervised the towing of the *Hercules* into the hangar.

Once finished, he walked back to the deadman switch and repositioned first one door, then . . .

Where was the other one?

It was gone.

Seventy-six thousand pounds of inert metal had disappeared.

Bewildered by the gaping space where the door used to be, he and a fellow aircrewman followed the tracks and found the door at the opposite end of the rainbow, butted against another door on the same set of tracks.

Like a vertical glacier, the 76,000-pound electrically-driven hangar bay door had slowly moved 153 feet during an approximate 10-minute period, "unnoticed, unaccompanied and unimpeded by 14 inches of a Navy C-118's tail overhanging the innermost set of four hangar door tracks, where it had been 'safely' parked and chocked two days earlier."

Imagine the ruined aluminum of the C-118's shiny vertical stabilizer.

Are you laughing? Sure, it's pretty amazing, the thought of "losing" a 76,000-pound electrically-driven hangar door for 10 whole minutes as it inched its way into immortality.

Most of us never make mistakes that visibly grand. Instead, we lose intangible hangar doors without knowing it, like letting our instrument proficiency slowly slip away or letting the quality of our preflights quietly disappear.

Turn around.

Something may be slowly getting away from you.



LT Colin Sargent

D202.13128/12

374-A

approach

THE UNIVERSITY
OF MICHIGAN

JUN 28 1983

ENGINEERING
LIBRARY

Vol. 28 No. 12
NAVAIR 00-75-510



An AV-8A Harrier rises out of its shadow during Atlantic operations aboard the USS SAIPAN. Photo by PH1 Bill Cline.

Lightning and Naval Aviation 2

By LT Colin W. Sargent. Flash blindness, brush discharges and electrical spirits that disturb your avionics.

The NATOPS "Bible" Myth 8

By CDR A. S. Polk III. "They" don't write NATOPS — we do!

Treed and Trucked 18

By Russ Forbush. Weight, balance and two embarrassed Sea Stallions.

A Look Into the FAA's Lightning Study 7

By LT Colin Sargent

Elmo, Patron Saint of Night Tanker Crews 11

By LT John Flynn

Hold Your Breath 12

By Richard A. Eldridge

Air Breaks 14

Two Seconds From Eternity 16

By Richard A. Eldridge

If There Is Doubt, There Is No Doubt! 23

By LT R. R. Wolfe

Bravo Zulu 24

Double Flameout 26

By LT Gary C. Bowser

Clouds, Mountains, a Green Windscreen 28

Anonymously submitted

Toward A Better Safety Program? Quickly — Follow Alice! 29

By CAPT S. P. Dunlap

Tomorrow May Be Too Late! 31

By LCDR Tom Sobieck

Letters 32

RADM T. C. Steele, Commander, Naval Safety Center

CAPT H. A. Petrich, Chief of Staff

CAPT S. P. Dunlap, Director, Aviation Safety Programs

CDR C. E. McCaskill, Head, Safety Publications

LT Colin W. Sargent, Editor

Robert Trotter, Art Director

Richard A. Eldridge, Writer

Russ T. Forbush, Helicopter Writer

Joe Casto, Writer

Blake Rader, Illustrator

Jack LaBar, Illustrator

Frank L. Smith, Graphics

PH2 Ronald K. Bellenot, Photographer

PH3 Mary S. Webb, Photographer

Patricia A. Kinter, Type Composer

Theresa K. Barnes, Type Composer

Nancy Hupman, Publications Manager

Doris Sumner, Circulation

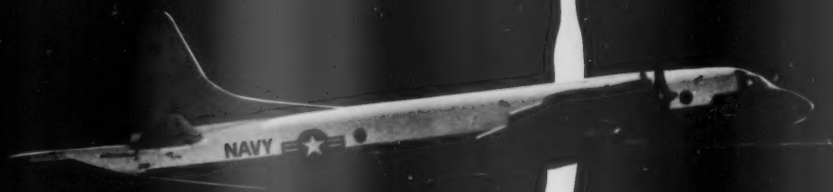
UNIVERSITY OF MICHIGAN
LIBRARIES

JUN 14 1983

DEPOSITED BY THE
UNITED STATES OF AMERICA

Contents should not be considered as regulations, orders, or directives and may not be construed as incriminating under Art. 31, UCMJ. Views of guest-written articles are not necessarily those of NAVSAFECEN. Photos are Official Navy or as credited. Photographs used have no strict relationship to the text. Official distribution handled by NAVSAFECEN, Safety Pub. Dept., NAS Norfolk, VA 23511. Phone: (804) 444-1321; Autovon 690-1321. Printed in accordance with Dept. of the Navy Publications and Printing Regulations, NAVEXOS P-35. Library of Congress Catalog No. 57 60020.

LIGHTNING



and Naval Aviation

The University
of Michigan
Transportation
Library

IMAGINE yourself flying a P-3C *Orion* at night. Dark clouds have shouldered their way between you and your destination, NAS Keflavik, so you descend to 6,000 feet MSL and deviate 25 miles west of course to penetrate the front at its narrowest point. During the penetration, you encounter light turbulence, light to moderate rain showers and no icing. Then, approximately two miles from clearing the front, it happens. A brilliant white light blinds everyone in the flight station for periods varying from 15 seconds to one minute. The instantaneous memory of the strike burns in your brain while you wait for your vision to return. As far as you can remember, the bolt struck your *Orion* directly on the nose.

Well, at least you're still flying. How could it have happened? No lightning had shown itself before the strike, and there are no other flashes now. Your radar is inoperative, but otherwise, everything seems fine as you hightail it into Keflavik to file your hazard report.

When you land, you'll find a two-foot crack in your nose radome featuring soot-like burns and a softball-sized central hole.

What is a lightning strike?

It's a concentrated zap of over 40,000 blue amperes. It's a force that can hit a wet squadron ramp 100 feet away from a maintenance technician installing a cannon plug on an aircraft, travel in a flash across a series of puddles, run up his B-5 metal workstand and thrill his arms and legs with electricity as it passes through the cannon plug to the airframe.

It's a brilliant force that can do the following to an A-6 crew:

With a twilight surveillance mission complete, the *Intruder* entered Marshal at 15,000 feet for a night CCA recovery. During penetration; moderate rime icing appeared on the windscreen and leading edges of the wings. Saint Elmo's fire began as a dull blue glow on the IFR probe. Ice dissipated below the freezing level, and the Saint Elmo's fire stopped once clear of clouds. The aircraft leveled at 2,000 feet and was vectored outbound due to priority traffic. While

returning inbound at 20 nm from the carrier, 250 knots and clear of clouds, the aircraft was nailed by a lightning strike on the IFR probe. Both crewmembers were temporarily flash blinded from one to two minutes. An instantaneous loss of electrical and avionic capability was experienced. After recovering from the flash blindness, the *Intruder* crew trapped uneventfully aboard the CV with some frayed nerves and a great story for the readyroom.

Are lightning strikes on flying aircraft deadly? No. Fatalities have been extremely rare. Aircraft manufacturers do an excellent job of installing Faraday cages, grounding wires, static wicks and grounding straps within the airframe to protect you from injury.

Here's one example of the care taken to ensure that components are designed for lighting strikes.

If you visit the *Boeing Vertol* plant near Philadelphia, Pa., they'll show you a little black room where fiberglass rotor blades are systematically zapped with 200,000 amperes of ersatz lightning to ensure that the thin metal guidewires molded into the blades carry the charge safely past the fiberglass and into the transmission. Every blade prototype undergoes this demanding test before qualification.

I'm wading through a Naval Safety Center computer run right now that lists over 470 reported lightning strikes and static discharge incidents during the last 10 years, and there isn't a fatal case among them. The biggest factor seems to be a crew's ability to regroup after the visual shock and accompanying bang of a strike.

Getting hit by a bolt of lightning is like getting a snap quiz in crew coordination. Here's an example of some good lightning headwork:

An S-3A *Viking* was proceeding outbound at 5,000 feet, 270 KIAS. The aircraft was totally IFR at the time with thunderstorms in the vicinity. The aircraft commander, occupying the left seat, noticed three zig-zag lines approaching his windscreen. When the zig-zags hit the aircraft, an extremely bright flash occurred along with an explosion sound (similar, the report states, to the flash experienced in a

nuclear blast trainer). The *Viking's* windshield heat was off and pitot heat was on. The pilot in command was flash blinded for approximately two minutes, but the copilot could see out of his right eye. The crew set an immediate climbing attitude, and VFR conditions were obtained at 13,500 feet.

Weather permitting, when in doubt and close to blue waves, rocks or trees, climb!

The flight was completed without incident.

While lightning strikes aren't in themselves very deadly, they can throw your electrical components and avionics for a loop. Consider the case of this electrically-stunned S-3A *Viking*:

On departure climbout passing 10,000 feet, the aircraft encountered air-to-air lightning. The visibility was 0/0 due to a rainy overcast, and when one supernatural bolt of lightning hit the airframe, all UHF communications were lost, the TACAN unlocked (some TACAN's unlock if you just whisper the word lightning to them), the INS failed, the speed brakes deployed 10 degrees, the bomb bay doors opened, FLIR deployed, the probe out light illuminated and the No. 1 and 2 spoiler servo switches disconnected.

All of these were uncommanded electrical consequences. The crew obviously had its hands full with this bird. After 10 minutes, they regained UHF communications via UHF-1. The pilot's ICS was regained by selecting alternate (the copilot's never came back), the speed brakes were retracted via the spoiler No. 1 and 2 servo switches, the bomb bay doors were closed via the bomb bay doors open/transition switch, the probe light extinguished after recycling the probe switch, and FLIR was retracted via the FLIR emergency retract switch. Our old friend the TACAN? It sheepishly came back on the line after five minutes of erratic behavior.

The only permanent damage was to the INS. A postflight inspection revealed that the IMU was internally damaged as a result of the strike.

Though lightning doesn't leave fingerprints and every bolt is different, you can predict an imminent lightning strike to a limited extent, according to an article in the Summer 1982 issue of *FLIGHT CREW Magazine*: "Lightning rarely causes significant structural damage, but it is unnerving, can cause temporary blindness and can disrupt radios and compasses. A rapid buildup of static in the headset may sometimes be an early warning of an imminent lightning strike."

The presence of Saint Elmo's fire (or "brush discharges") is another tip that lightning is about to strike. A few brush discharges on, say, an *Intruder's* IFR probe, can grow and glow by ionization. Once a hundred or more individual charges accumulate, they can arc and complete the path between points of opposite polarity necessary for a lightning strike. When this preliminary leader stroke reaches its destination, cautions the *AMERICAN PRACTICAL*

NAVIGATOR (Bowditch), "a heavy main stroke immediately follows in the opposite direction. This main stroke is the visible lightning, which may be tinted any color, depending upon the nature of the gases through which it passes. The illumination is due to the high degree of ionization of the air, which causes many of the atoms to be in excited states and emit radiation."

Believe it or not, lightning is most dangerous to Navy flight crews on the ground. On one occasion, a crew chief sustained major injuries as a result of this strike:

A CH-46 *Sea Knight* had just finished a 5-hour flight and was on the transient flight line of a naval air station, about to shut down. The crew chief, on the long ICS cord for a walkaround inspection, checked the aircraft clear of obstacles and told the pilots that the helo was ready for shutdown.

At that moment, a very loud bang startled the entire crew. Over ICS, the crew chief said, "I'm hit!" He then fell to the ground, raised his head and again transmitted, "I'm hit!" Finally, he rolled over on his back, twitched once or twice and then went limp. One of the pilots unstrapped and immediately administered first aid. Soon crash, fire and ambulance vehicles arrived and rushed him to the hospital. Flight line observers later reported seeing a solid fist of lightning strike a hangar about 100 meters away from the *Sea Knight*. It's probable that the lightning traveled through the cement mat and was picked up by the 30-foot-long ICS cord trailing the crew chief.

Perhaps now when you hear that your aerodrome has set Thunderstorm Condition I, you'll realize the statement has import both on the ground and in the air.

In the case of the maintenanceman jolted on the B-5 checkstand earlier in this article, Thunderstorm Condition I had been set at the field minutes before the incident, and neither the man nor his supervisor had been informed of the change in weather status.

If there's a myth at all about lightning it is this: Lightning seems to favor heavy-weather birds like A-6s, P-3s and, traditionally, *Super Constellations* as targets. Here's the story of one helicopter crew that learned otherwise.

A CH-46 *Sea Knight* took off from an LPH and started a climbing turn to the left. The copilot leaned over to switch his UHF channel to HDC. While he was leaning, a bright flash lit up the air to the left of the aircraft. As a result, the radio would not channelize on either preset or manual control. Looking up, the copilot saw the No. 2 generator caution light illuminate, followed immediately by the K-81 generator caution light. The copilot tried to reset the generator. No go. He checked the circuit breakers in. While this was in progress, the pilot shouted that he was unable to control the aircraft due to extreme vertigo brought on by the flash. The copilot assumed control at 800 feet MSL in inadvertant IMC with the aircraft 45 degrees nose up in a right-hand turn at 30 to 40 knots indicated airspeed, engines



Getting hit by a bolt of lightning is like getting a snap quiz in crew coordination.

5

at topping power and an N_r of 98. Leveling the helicopter, the copilot regained control, sighted his ship through the clouds below him and descended to 200 feet MSL. Meanwhile, the pilot started the APU and brought electrical power back on the line. A normal landing ensued.

Once again, it's not so much what happens during a lightning strike, it's what you do after a strike that counts.

Lightning is "attracted" to the charged parts of your aircraft. Ira J. Rimson, in his "Lightning Revisited" feature for *FLIGHT CREW*, puts it this way:

"Several locations are more susceptible to lightning strikes than others: wingtips and ailerons, antennas, vertical stabilizers and nose radomes. The susceptibility of nose radomes — even though they may themselves be nonconductive — lies in the fact that the metallic components inside (which are highly charged with electrical/electronic energy) often discharge toward the lightning streamer. Vaporization of the fiberglass resins by lightning electrical energy has been known to cause the laminate to rupture and 'explode.'

"Antennas are a route for lightning to enter the aircraft cabin, endangering both personnel and equipment. Flight controls must provide a means for transferring current between fixed and moveable surfaces. Thus the importance of properly installed lightning arrestors on antenna lead-ins, and bonding cables on the control surfaces.

"Under certain circumstances, fuel systems can be extremely vulnerable to lightning hazards. In a recent transport accident, lightning-generated current may have been responsible for arcing within a fuel tank which led to inflight explosion.

Continued

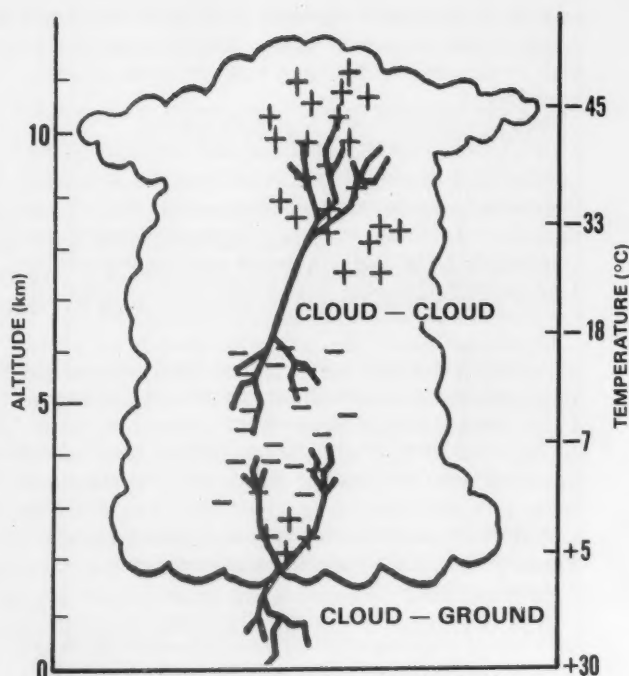


Fig. 1 Distribution of charge in a thundercloud.

"Residual magnetism is a common result of lightning strikes. The intense electromagnetic field associated with a lightning strike will magnetize the ferrous metals of the aircraft. As a result, magnetic compasses become unreliable, and other instruments and systems which contain ferrous metal components can be adversely affected."

The Rimson article also features results from a lightning study conducted by General Electric: "The General Electric Company studied more than 200 aircraft lightning strikes; 78 reported no effects on the aircraft, 32 had some radome damage, 40 experienced interference or damage to instruments, 27 had static discharger damage and 27 showed holes burned or skin panels damaged . . ."

"Most lightning strikes occur near convective atmospheric activity, but thunderstorms need not be present," Rimson continues. "The General Electric study revealed that:

- * 96 percent of the strikes occurred below 25,000 ft. altitude, and the remaining 4 percent between 33,000 and 37,000 ft.

- * 88 percent occurred during precipitation.

- * 84 percent occurred while the aircraft were in clouds.

- * 81 percent occurred during reported turbulence.

- * 68 percent involved aircraft which were climbing, descending or making an approach.

- * In 50 percent of the incidents, electrical activity of lightning was evident nearby before the strike."

Lightning strikes are currently getting a lot of attention. According to Nickolus O. Rasch, a researcher with the FAA, there's a whole group of FAA experts devoted to the study of air-to-air lightning dangers to aviation. They're so immersed into the subject matter that they've purchased blue lapel pins with lightning bolts on them as study identifiers.

With pins like that, they must mean business.

Of course, one sure-fire way to improve your odds against running into lightning is to avoid flying into forecast thunderstorm conditions. By a wide margin. Even if you think you're miles away from the nearest embedded cell, you could still be hit by lightning (even if you're sporting a blue FAA anti-lightning pin), though most strikes originate in the heart of a thunderstorm, near the freezing level.

It's axiomatic, really. If you're hit by lightning, you aviate, navigate and communicate — in that order. Because that response is second-nature (hopefully) to Navy and Marine Corps aviators, we've done very well . . . in the air . . . so far. In flight, naval flight officers and enlisted radar sensor operators have considerably lengthened our margin of safety with their cathode ray crystal balls. And, simple as they are, static wicks do a terrific job of discharging zaps of lightning into the atmosphere almost immediately.

Attaboy, static wicks!

Like static wicks, we also have something to discharge in the event of a lighting strike: smoothly-coordinated cockpit responsibilities. Between that and the wicks, we've got it licked.

Recently, the FAA has begun a fundamental rethinking of the design considerations needed to protect new generation (composite-built) aircraft and their electrical systems from lightning strikes.



A Look into the FAA's Lightning Study

An S-3A Viking was IFR at FL 180. There was no visible lightning in the area. Suddenly, however, the Viking's bomb bay doors cycled open and closed three times. Poltergeists at 18,000 feet? Certainly not. When the aircraft landed, the flight crew discovered a pinhole-sized static electricity burn mark at eye level on the windscreen. The windscreen had conductive strips installed as per ECP 27, but they apparently hadn't been able to prevent a disruptive pulse of electricity from spiriting itself into the Viking's wires.

It's stories like this that interest Nickolus O. Rasch, who leads the FAA's study on lightning and static electricity. Author of *A Compendium of Lightning Effects on Future Aircraft Electronic Systems*, an excellent and technically superior book you can get for free by writing to the

National Technical Information Service
Springfield, Virginia 22161

or by calling (commercial) 609-641-8200, extension 1144, Mr. Rasch will be conference chairman at the 1983 International Aerospace and Ground Conference on Lightning and Static Electricity at the Fort Worth Hilton Hotel, Fort Worth, Texas, June 21 to 23. For more information, call him at the FAA Technical Center, Atlantic City, N.J., using the same number listed above.

"During the three-day conference," an FAA report promises, "international experts in their fields will present over 100 papers on the latest lightning and static electricity research findings. In addition, the latest methods of protecting aircraft, helicopters, aerospace vehicles and ground facilities against atmospheric electrical hazards associated with lightning and static electricity will be presented."

In his *Compendium of Lightning Effects on . . . Electronic Systems*, Mr. Rasch writes that "two primary factors have contributed to an increased potential hazard to new generation aircraft:

- (1) The increasingly widespread use of digital microelectronic subsystems and/or avionic equipment which are inherently susceptible to upset and damage caused by electrical transients to implement flight and mission critical functions; and (2) the reduced electromagnetic shielding provided by many advanced structural materials. Present military and civil design guides and standards are being reviewed to assure adequate protection for new generation aircraft."

The effects of lightning and static electricity on avionic subsystems leave us with a chilling thought: What if the S-3A Viking with the 3-cycle (uncommanded) opening and closing bomb bay doors had been carrying a heavy load of ordnance? This isn't an isolated occurrence, either. The bomb bay problem has happened over a dozen times in the last 10 years.

LT Colin Sargent

The NATOPS "Bible" myth



By CDR A.S. Polk III

8

Pt1 Ralph W. Hoffman



There is no magic, no anonymous "they" and no direct penmanship scrawled by the hand of God.

THE Naval Air Training and Operating Procedures Standardization (NATOPS) flight manual is often called "the bible." This nickname first began to glow in our imaginations because the words in NATOPS were chopped at a very high level. There are, however, substantial differences between The Bible and "the bible."

Naval aviators are constantly reminded of the significance of NATOPS. Their health and well-being depend on their compliance with the big blue book, its companion publications and the continuous program of self-study, group discussions and testing surrounding it. I wholeheartedly agree with this, but the nearly blind faith which NATOPS generates must be well founded. The implementation of the NATOPS program must be justified by the facts contained between the plastic covers.

Where do the NATOPS "words to live by" come from? The answers are found in two publications: Military Specification (MILSPEC) MIL-M-85025A (AS) of December 1980 and OPNAVINST 3510.9G of 14 May 1980.

The MILSPEC (Manuals, NATOPS Flight: Requirements for Preparation of) is produced by the Engineering Specifications and Standards Department of the Naval Air Engineering Center in Lakehurst, New Jersey. The MILSPEC is a standardization document. In 224 pages it indicates in great detail the exact organization and content of all NATOPS flight manuals. Nothing is optional. Even grammar is specified. "The second person imperative mood shall be used for all operation procedures (e.g., 'Check tip tank fuel level') . . ." The aircraft manufacturer initially produces the Preliminary NATOPS manual. This and subsequent manuals are based on the MILSPEC.

OPNAVINST 3510.9G contains information for implementing the NATOPS program. Included are detailed procedures for making changes to NATOPS publications. The heart of the answer to the question, "Where do the words to live by come from?" rests with the OPNAV instruction:

"Standardization based on professional knowledge and experience provides the basis for the development and practice of sound operating procedures . . . NATOPS manuals, NATOPS flight manuals and checklists are developed by the users for the users. Increased aircraft familiarity, changing operational requirements and new developments will require continued updating of these publications. Necessarily, the users must accept the primary responsibility in this regard. If an individual knows a better procedure, or sees conflict between NATOPS and other doctrine, the individual is obligated to propose a change to the

applicable publication. Initiative in formulating new or improved procedures must be encouraged.

"NATOPS publications must have inputs from many sources in order to maintain the effectiveness of the program. To accomplish this, anyone in the naval establishment who notes a deficiency or an error is obliged to submit a change recommendation. The participation of the individual in this program of continual manual improvement is imperative."

Emphasized phrases in these statements relate to individual responsibility. This is the key to the NATOPS program. We, the users, write the manual for ourselves and each other. There is no magic, no anonymous "they" and no direct penmanship scrawled by the hand of God.

The Preliminary NATOPS manual received from the aircraft manufacturer is not a final product. It is the first attempt at a dynamic working document which may never be perfect. The book will contain obvious or subtle imperfections — much like the aircraft to which it applies. The Preliminary NATOPS has received careful attention at numerous levels before being released as the first NATOPS flight manual for an aircraft. It is only the first manual. Imperfections, aircraft modifications and experience will necessitate manual changes. Many changes will be dictated by a higher authority, but the user is of vital importance.

Aircraft problems usually lead to yellow sheet gripes at the end of the flight. Aircrews routinely accept the responsibility to record discrepancies after each flight for appropriate action to be taken by Maintenance. By doing so, we assist ourselves and other aircrews on subsequent flights. What happens when we take our NATOPS off the shelf for a review? During or after the reading, we should record discrepancies. But the practice is rare. Some errors persist for years — even though almost everyone acknowledges their presence.

There are some ridiculous excuses for leaving the mistakes in NATOPS — none are valid. Routine corrections are easily submitted, though they may take time for incorporation. Urgent change recommendations are equally easy to submit and produce rapid results.

You can submit routine change recommendations on a simple change recommendation form, OPNAVINST FORM 3500/22, stock number 0107-722-2002. A copy of the form, suitable for photocopying, appears in the front of your blue NATOPS flight manual. The blocks at the top and bottom are self-explanatory, and most can be prefilled and photocopied with the form to save time later. Change recommendations should be specific. Comments such as "paragraph is vague and should be rewritten" do little to

improve the situation. Instead, write, "Change paragraph to read (state the exact rewrite)." The justification section may be the most important part of your recommendation. Though some errors are obvious, others may require the most creative salesmanship you can muster. Additional documentation or graphics may be appended. Sign the form and submit it to your NATOPS officer. That's all you need to do. The rest is automatic. Most commands like to record these submissions for reference when writing nominations for safety awards, Battle E and other forms of recognition.

Substantive change recommendations can also be good topics for aircrew meetings and safety standdowns. The unit NATOPS officer will forward your change to the model manager for inclusion in the next NATOPS conference. If the model manager sees fit, he may upgrade the change recommendation to "Urgent."



Urgent changes are sent by priority message to the NATOPS advisory group member in your chain of command, such as COMNAVAIRPAC, CNATRA, CNAVRES or CG FMFLANT, with information copies sent to the model manager and other commands. Your NATOPS officer knows all the addressees. The format is simple and found in OPNAVINST 3510.9G. Members of your command may wish to write your message in more inspired prose before the CO signs it, but once released, your recommendation will receive prompt attention. If approved by the advisory group member, it is forwarded to cognizant commands who must submit their preliminary comments within three days. Final concurrence or nonconcurrence must be submitted to CNO and others within six days.

Revisions and changes are issued through priority messages when the urgency so warrants. Normally, a printed form is issued. An advance distribution may be made, and this is always followed by a printed interim change.

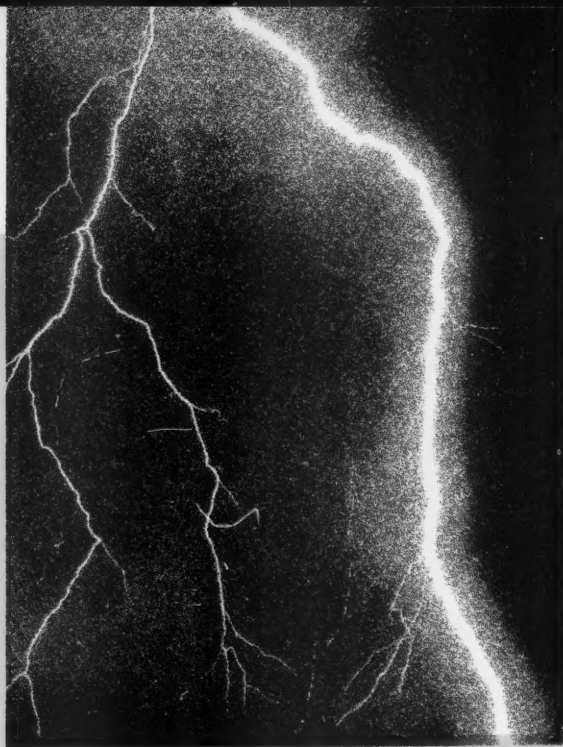
NATOPS conferences convene to review all interim and proposed changes in order to produce updated manuals. Commands in the know determine the need for conferences based on recommendations from the model manager and the Navy Tactical Support Activity (NAVTACSUPPORT). Conferences normally are held at the manufacturer's facility for in-production aircraft. The voting members at the conference are limited to direct representatives of advisory group members, the model manager and NATOPS evaluators. While there are CNO, manufacturer and technical representatives present, the conference decisions are made by representatives of aircraft user commands. NAVTACSUPPORT then publishes the revisions.

The entire NATOPS manual change procedure is simply and clearly defined. The first step involves the user. When the user sees a problem, he must initiate action to correct it through the NATOPS Change Recommendation form or message. Through this established procedure, the best possible information, chopped at a high level, will be published for all to share.

A recent issue of *APPROACH* published a well-intentioned letter concerning "a perceived NATOPS Murphy" which may have contributed to another's in-flight problem leading to ejection. The author credited his own experience in a trainer which led him to the habit of writing additional notes in his pocket NATOPS. **If such comments had been made on a change form, the knowledge would have been available to all operators.**

All of us who fly in or maintain aircraft have an obligation to maintain our NATOPS manuals to the best of our ability. Though "words to live by" may have a mystical quality, they do not come directly from God. The words come from us.

CDR Polk knows whereof he speaks. Last year alone, he submitted over 30 E-2 NATOPS changes, and at this writing, almost all of them have been incorporated. — Ed.



Elmo, the Patron Saint of Night Tanker Crews

By LT John Flynn
VA-65

AFTER consolidating with the offgoing KA-6D, the last night tanker was sent to 3,000 feet to hawk the recovery which had just begun. The ship, running into the wind, was also running into a solid line of thunderstorms. The tanker crew, unable to maintain sight of the carrier or the CCA pattern in the reduced visibility, informed Departure that they were climbing to find a layer of clear air in which to tank low-state aircraft, if and when it became necessary. They were able to maintain a marginal, in-and-out-of-clouds condition at 5,000 feet. Shortly after they leveled off, they began to notice an eerie blue glow on the aircraft.

For the BN, who only had a few hundred hours in his logbook, this was his first encounter with St. Elmo's Fire. The pilot however, was on his third fleet tour, had well over 2,000 hours and had seen it many times before, but not like this! A ball of neon-blue light about a foot in diameter was centered on the tip of the refueling probe, sparkling with tiny bolts of electricity. The canopy frame was outlined with the same blue glow, as were the slats. Electrical arcs as long as four feet were jumping from the leading edge of the wings to the droptanks. Arcs created a cobweb pattern in the gunsight. The phenomenon was accompanied by static on the UHF radios, intense enough to render them almost unusable.

The BN curiously moved his hand slowly toward the canopy frame and found he could maintain a 1/2-inch electrical arc between his fingers and the metal framework. There was no shock, only a mild tingling sensation. The pilot, being older and wiser, resisted the BN's encouragement to "try it yourself." Instead, the PIC elected to climb higher, hoping to find better conditions. The change in altitude diminished the effect considerably, and the hop continued with no further problems.

St. Elmo's Fire, also known as St. Peter's Lights and "corposant" (from "corpo santo" meaning "the body of a saint"), has been known to mariners for centuries as the luminous discharge which emanates from the masts and yardarms of ships during storms. St. Elmo, properly called St. Erasmus, was once the patron saint of Portugese and Italian mariners. The blue glow was thought to be a manifestation of his protection of a ship from a storm. For aviators, however, St. Elmo's Fire is not protection at all, but the warning of a potential lightning strike!

Bowditch, in *The American Practical Navigator*, describes it as a "brush discharge" of static electricity which occurs when there is a great difference in the electrical charge between an object and the surrounding air, and that it may be the initial phase of the leader stroke of lightning. Not surprisingly, a review of lightning-related aviation incidents reveals many cases in which St. Elmo's Fire was observed on an aircraft shortly before it was hit by lightning. Even without associated lightning, St. Elmo's Fire has caused bomb bays to open and close, speedbrakes to open, radios to switch off, inertial navigation systems to dump and a variety of other odd electrical disturbances.

While St. Elmo's Fire may be visually fascinating, it should be avoided, if possible. Steering clear of the storm is the obvious solution, but when that isn't feasible, changing altitude may help. The brush discharge is enhanced by water droplets striking the aircraft, so changing course to avoid precipitation may also provide a solution. Of course, a little prayer to St. Elmo couldn't hurt either.

Hold your breath

By Richard A. Eldridge
APPROACH Writer

12

THERE'S **nothing quite so final** in a tactical jet aircraft as the moment when you realize you're in *extremis* and the situation is **not** going to improve. At that instant you pin your hopes on your ejection seat and hold your breath.

Two instructor pilots in a TA-7C found themselves in just such a situation during a night flight. "We were in a glide and obviously in *extremis*. Over the ICS, we decided that ejection was our only option, so we turned the aircraft away from the populated area beneath us. Finally, passing 5,000 feet MSL (ground elevation was 4,000 feet), I said, 'Let's get out of here now. Initiate the ejection.' The front-seat pilot said, 'Roger, stand by for the jolt. Here we go.' Just before the shot, I saw 4,800 feet MSL on the altimeter with a descent rate of 1,800 to 2,000 fpm."

Both pilots ejected successfully, although the pilot in the rear seat hurt his face during the initial phase.

Up to a few moments before the flash of their ejection, it had been a routine night weapons spotting hop. The two instructors were safety observers for two separate and successive flights of A-7s engaging in night dive bombing training. The hop was almost complete. Only one aircraft in the second flight was still in the bombing pattern . . .

It had been two hours and 37 minutes since the two instructors had taken off. The fuel gauge in the front cockpit indicated 900 pounds, while the pilot in the rear seat (controlling the aircraft) noted 800 pounds on his gauge. At that instant the FUEL BOOST pump caution light illu-

minated, followed almost immediately by engine thrust, RPM and fuel flow surges. The pilot immediately turned homeward and selected manual fuel. Approximately 15 seconds later, the RPM began to decay and the engine flamed out. When the EPP (Emergency Power Pack) was deployed, electrical and hydraulic power were restored, but attempts to restart the engine were unsuccessful. There was no indication of fuel flow. At the time of flameout, the aircraft was at 3,000 feet AGL, 220 KIAS in level flight. **The low fuel warning lights did not illuminate at any time.** It was concluded that the TA-7 flamed out because of fuel exhaustion.

OPNAVINST 3710.7K states that "In no case shall the planned fuel reserve after final landing at destination or alternate airfield, if one is required, be less than that needed for 20 minutes flight: turbine-powered fixed-wing aircraft — compute fuel consumption based on maximum endurance operation at 10,000 feet."

For the TA-7C, the OPNAV minimum fuel required for 20 minutes of maximum endurance operation at 10,000 feet MSL is 700 to 800 pounds, depending on the angle of bank (0 to 30 degrees). This information was obtained from TA-7C flight tests conducted at NAS Patuxent River.

From the TA-7C NATOPS manual it was determined that a fuel reserve of 750 plus or minus 50 pounds would satisfy the requirement for the 20-minute fuel reserve on landing.

One of the ejectees later said both pilots were watching the fuel very closely. In order to complete the second group, they knew they'd be landing below their preflight-planned minimum of 1,500 pounds. When the M needle was indicating 1,000 pounds, the totalizer was reading 100 to 200 pounds higher.

Soon afterward, the M needle pointed to 900 pounds, and still no fuel low lights flickered on. The pilots made a mental note to down the aircraft upon landing, since 900 pounds is the lower limit for the illumination of the low fuel light in the TA-7C.

They suspected they had a bad fuel indicator that was indicating less fuel than the "true" amount on board; therefore, there was no need for the fuel low limit light to be illuminating, yet.

With this in mind, during the latter portion of the second event, the limit set by the instructors for the mandatory return to base was the NATOPS Bingo overhead reserve of 800 pounds. After the last plane's final run, they were going to commence a turn toward the field and enter a left downwind pattern for landing. This maneuver would take about 100 to 150 pounds of fuel to complete. As they approached abeam the target, however, the fuel boost light illuminated with the fuel quantity indicating 800 pounds on the M needle. There was still no low fuel light.

After the crash, both fuel quantity indicators were recovered and sent to experts for an engineering investigation (EI).



The EI indicated that the dual thermistor control unit (A-251) was defective prior to aircraft impact. *The unit controls the lighting of the low fuel quantity warning light.* Thirty-six flight hours before the mishap, the warning system had been flight checked with positive results. It was not flight checked after an engine change 19.6 hours prior to the mishap. The low fuel warning light operates independently of the fuel quantity indicating system and is not dependent upon proper calibration of the fuel quantity indicating system. Therefore, material failure of the low fuel quantity warning light was a factor in that the instructors did not receive the warning of low fuel that they would normally have expected to receive.

Although there's an OPNAV requirement that aircraft NATOPS manuals contain minimum fuel reserve requirements, the TA-7C NATOPS did not comply. However, Bingo fuel requirements plan for an 800-pound reserve overhead the field for landing. While this may seem to be a reasonable figure to use as a NATOPS minimum fuel reserve, the mishap aircraft would still have flamed out.

The squadron SOP states that all flights should plan to be on deck with a minimum of 1,500 pounds of fuel. Later, in an interview with one of the instructors, he stated that the squadron SOP fuel reserve requirement was 1,500 pounds or a low fuel light, whichever came first. It was also his opinion, when asked what the fuel requirements were for instructors, that there were no SOP requirements for instructors. Despite the beliefs and opinions held by the

instructors, had the squadron SOP been followed, the aircraft would have landed safely.

Another factor which surfaced concerned the manner in which the aircraft's fuel quantity indicating system was calibrated. The procedures for calibration are contained in NAVAIR 01-45AAF-2-3.7 WP00801. They call for using the TF-20-1 capacitance-type liquid quantity system test, the 215-01-031-1 flight line fuel quantity gauging test set and the 220-09074-101 adapter cable. The test sets check the capacitance fuel probes and associated wiring of a fully fueled and fully defueled aircraft. The sets also simulate a full fuel capacitance (10,200 pounds) and an empty fuel capacitance. These simulated capacitances are applied to the quantity indicators, which are adjusted to read the appropriate simulated quantities.

The same maintenance personnel who last calibrated the mishap aircraft were later observed as they calibrated a similar TA-7C. The test aircraft was defueled, and the indicators were adjusted to read 300 pounds. This was done to compensate for the 300 pounds of fuel trapped in the aft fuselage fuel cell. Next, the TA-7C was fully fueled, and the indicators were adjusted to read 10,200 pounds. The calibration was then considered complete. *At no time was the prescribed test equipment used.*

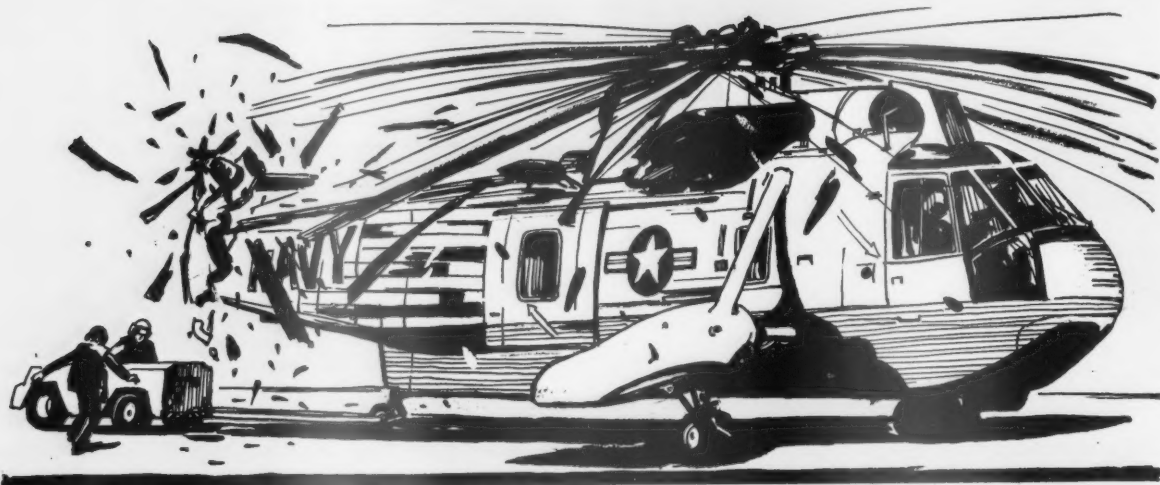
After this irregular calibration procedure was over, the maintenance personnel were asked to produce the publication they'd followed. There was none, since the procedure used is not found in any maintenance instruction manual. They justified their actions by stating that the authorized procedures are time-consuming and require an awkward three-piece test set as well as the unpleasant task of completely defueling the aircraft. The maintenance personnel involved felt that systems calibrated with the test sets were not as accurate as the method they used. *Further questioning of other maintenance supervisors, NAMTRA-DET instructors and FRAMP instructors revealed that the method witnessed was the norm rather than the exception in the A-7 community.*

When contacted concerning this procedure, the Vought Corporation stated that the **only** valid method is the approved calibration procedure using the test sets. When properly performed, that procedure will result in a fuel calibration that meets design specifications.

Because of this mishap, the squadron rewrote the SOP concerning minimum fuel reserve in order to eliminate any possibility of misinterpretation or confusion.

The functional wing commander took action to identify and direct immediate action for those commands using unauthorized fuel quantity calibration procedures and to certify proper aircraft calibration.

Additionally, NAVSAFECEN Flight Safety Advisory 181942Z Feb 82 addresses the subject of incorrect calibration methods and their consequences plus proper and accepted procedures, equipment and guidelines. ◀



MOB Scene. A CV and its air wing were undergoing fleet training. One week earlier, in anticipation of a man overboard (MOB) drill, the SH-3 embarked squadron's operations officer had briefed all pilots on man overboard drill procedures, including time requirements for obtaining maximum points for the evolution. Following this speech however, the squadron's XO stressed that obtaining maximum points was of secondary importance. He emphasized that compliance with NATOPS and safety procedures would be the overriding factors.

Now, let's get on with the events leading up to the mishap. At 0730, the assigned aircrew conducted a standard NATOPS brief. The crew then stood by awaiting the return of Angel No. 101, which was scheduled to be the alert helo. Air Operations informed the squadron that when 101 returned it would remain spotted in an alert status. In the meantime, another SH-3, Angel No. 105, was assigned as the alert helo pending return of 101. At 0840, a third squadron pilot who had attended the NATOPS brief preflight-

ed 105, since the assigned copilot was attending a damage control brief.

At 0900, the squadron was surreptitiously informed by Air Operations of an imminent MOB drill, and 105 was assigned as the recovery helo. The aircrew was then notified, and they headed for the aircraft. The copilot, who was scheduled to be the pilot at the controls, arrived first, entered the helo, strapped into the right seat and began randomly going through the normal starting procedures checklist. The HAC was climbing into the aircraft when the MOB drill was sounded; meanwhile, a tow tractor was being hooked up. While being towed to Spot 3, the HAC informed the tower that 105 was too heavy to hover and fuel would have to be dumped. A moment later he was notified that fuel dumping would not be necessary since a motor whaleboat was the primary pickup vehicle. It was the intent of the air boss that the crew would complete the checklist up to the takeoff checklist, with no intent to launch. The crew, however, was not made specifically aware of the deci-

sion not to launch.

At 0940, 105 was spotted aft of Spot 3. External power was connected to the helo, and the main rotor blades and tail pylon were folded. There wasn't much crew coordination going on between the HAC and the copilot at this time — neither appeared to know what the other had done or was doing. The normal starting procedures checklist was not being followed. The No. 1 engine was started using the No. 1 emergency override switch since the tail pylon was in the folded position (the crew did not notice that the accessory drive switch was in the flight position). While advancing the No. 1 speed selector out of the ground idle position, the main rotor head rotated counterclockwise about 525 degrees with the blades still in the folded position. This resulted in substantial damage to several systems and components too numerous to mention here; however, the estimated cost of replacement and repair of parts amounted to over \$188,000.

Before discussing the factors leading to this mishap, it's neces-

AIR BREAKS

sary to describe a maintenance action which took place the evening prior to the mishap. At that time, maintenance personnel installed a linear actuator in 105. When the job was completed, the accessory drive switch was left in the flight position vice the accessory drive position. However, had the aircrew properly conducted their checks in accordance with the items listed in the NATOPS Pilot's Checklist (engine start), they would have been afforded five opportunities to check or have indications that the accessory drive switch was in the flight position. Let's look at them:

Item No. 1. "CIRCUIT BREAKERS AND SWITCHES — CHECKED." This should have alerted the crew to place all switches in either the "OFF" or "NORMAL" position.

Item No. 10. "BLADE PANEL (RADIOS SH-3D) HOIST, TRIM — CHECK." Compliance with this item would have shown that only the safety valve light and the pylon unlocked light were illuminated vice the safety valve open light, control lock pins advance light and blades folded light, better known as the safety triangle, which would be the normal indications at this time in the checklist sequence.

Item No. 14. "ACCESSORY DRIVE SWITCH — FORWARD, LIGHT ON." This would have provided a positive indication that the linear actuator was not in the accessory drive position.

Item No. 24. "ALL GAUGES — CHECKED." Compliance with this item would have provided the second positive indication of lack of accessory drive. A caution in the NATOPS Pilot's Checklist following Item 24 states . . . "LACK OF ACCESSORY DRIVE IS INDICATED BY THE LOSS OF HYDRAULIC (PRIMARY, AUXIL-

IARY AND UTILITY) PRESSURE, GENERATOR, POWER AND TRANSMISSION OIL PRESSURE." Furthermore, a complete check of all gauges would have indicated zero N_f on the No. 1 indicator of the triple tachometer (No. 1 N_f , No. 2 N_f and N_r combined tachometer).

Item No. 26. "SPEED SELECTOR — 104 PERCENT N_f ." Compliance with this item would have provided the third positive indication that the linear actuator was not in the accessory drive position. The pilot at the controls should have been watching for a rise in N_f , commencing from 45 to 50 percent with the No. 1 engine in ground idle. In this situation N_f on No. 1 was zero, providing the pilot with an opportunity to realize the lack of accessory drive.

Here were five positive opportunities for this aircrew to discover that the accessory drive switch was in the flight position. However, there was such a complete lack of crew coordination and communication from the time the crew manned the aircraft, neither of them had a handle on what was happening. While the crew was not specifically told that the aircraft would not be launched, PriFly had made it known that 105 was not the primary recovery vehicle, and that fuel dumping would not be necessary. Nevertheless, had 105 been the MOB pickup aircraft, the mishap would probably have occurred anyway because the stage had already been set.

This mishap should alert all aircrews that not following the NATOPS checklists to a "T" is asking for trouble.

Refueling Nightmare. The tanking evolution was proceeding normally. A flight of one A-3 and four AV-8

Harriers had rendezvoused with four KC-130 tankers.

This was the second tanking evolution on a TransLant for the *Harrier* flight. The A-3 *Pathfinder* was refueling from the starboard drogue of the third KC-130 while the *Harriers* were refueling from tankers one, two and four.

Due to weather on the track, tanking was being conducted somewhat higher than normal, in a right-echelon formation at FL240.

Small course changes by the formation were necessary to avoid the weather.

The A-3 was nearly topped off when a course change to the right was called by the Refueling Area Commander (RAC).

For reasons unknown, the No. 3 KC-130 pilot was slow to respond to the course change. A situation quickly developed with No. 1 and 2 now in a turn, closing rapidly on No. 3.

When the No. 3 tanker pilot finally saw what was happening, his reaction was to push over, pull power and underrun the formation — with the A-3 still taking fuel!

The A-3 pilot, with power at idle and speedbrakes out, attempted to break away from the KC-130. Due to the A-3's high gross weight and slow airspeed, this wasn't possible.

So, still plugged in to the drogue, the A-3 slid up under the wing of the KC-130, its left wing inches from the tanker's fuselage looking at a spinning prop only a few feet away.

After several moments, the A-3 was finally able to break away with no more damage than a bent probe tip.

A midair over the icy Atlantic was narrowly averted. A moment's inattention is all it took for this potentially disastrous situation to develop.

Submitted by D. L. Sturgeon

"The ejection occurred less than two seconds away from the edge of the ejection envelope."

Two Seconds From Eternity

TWELVE thousand feet. An EA-6B was in a right 4-G turn at 380 KIAS with another *Prowler* chasing it from the 5 o'clock position, simulating a guns attack. To counter the maneuver, the evading pilot said, "Stand by for a little negative G" and pushed forward smoothly on the stick, applying 1.2 negative G for about four seconds. About this time, the pilot heard a knock-it-off call and started to make a normal recovery. As the negative G was dissipating and the nose was starting up, the altimeter read 10,000 feet.

Suddenly the nose pitched violently forward. The crew's first thoughts were that the aircraft had departed controlled flight. However, as the pilot stated, "We had no buffet, and our airspeed was still over 350 knots. I knew I should neutralize the controls. I took my feet off the rudder pedals and retarded the throttle a bit. I saw that the stick was forward of the neutral position and pulled it aft six or seven inches. There was no effect on the aircraft — no positive G or buffet, just steady negative G. The stick felt the same as when you wipe it out in the chocks. I figured we had a stab disconnect or some control malfunction. I saw the altimeter falling below 7,000 feet, and our attitude was approaching 90 degrees nose down. I don't recall seeing any warning or caution lights. I didn't note the hydraulic gauges or the IPI (integrated position indicator) due to the short time available. From pitchdown until we passed 7,000 feet, I estimate three to five seconds elapsed.

"By then, I knew we couldn't recover safely, so I reached for the lower ejection handle. At the edge of my eyes I could see my ECMO-1 groping for his lower handle, but he was suspended by the negative G. I had trouble finding my handle, but I looked down and found it. I pulled the handle and felt a click. During my 1.2-second delay, I remember the aircraft starting to buffet as it does approaching .82 mach."

ECMO 1's Impressions. "We were in a right-hand turn and I told the pilot, 'He's in gun range now.' He answered that he was going to apply a little negative G, which he did for about six seconds. A moment later, I heard 'Knock it off! Knock it off!' We momentarily returned to positive G flight. I shot a glance at the altimeter and saw the number '11,' confirming my suspicions. Then the aircraft pitched violently nose down with the most instantaneous and disorienting negative G I've ever felt. Suspended in my ejection seat straps, I saw the altimeter rapidly unwinding past 10,000 feet. Next I looked to see what the pilot was doing with the stick, and it looked as if he were trying to pull it back. I returned my scan to the altimeter as it spun past 8,000 feet. I didn't notice any



CAUTION lights. Then I reached for my lower ejection handle but was unable to get hold of it due to being suspended in my straps. Therefore, I reached for the easily-accessible face curtain and pulled it."

ECMO 2's Impressions. "About one to two seconds later, I heard two knock-it-off calls with no response from our aircraft. At this time I realized we were in trouble for sure. The main reason was the way the negative G was applied. The first time it was a smooth transition. The second time it felt as if the pilot shoved the stick full forward with no regard for overstressing the aircraft. I'd looked at the altimeter 15 seconds prior, and we were not working in the vertical plane, so I knew we were somewhere near 13,000 feet.

"One last thought before I reached for the ejection handle was whether the plane had somehow gone into an inverted spin. I looked out and saw the plane was flying upright. Next I reached for the lower handle and had my fingers on it. The next thing I knew I was hanging in my chute."



By Richard A. Eldridge
APPROACH Writer

local loggers four hours to work their way up the tree and rescue him. Later all three aviators were rescued by a SAR helicopter.

Like the other two crewmen, the ECMO-2 lost consciousness after ejecting, but he came to 1,000 feet above ground level. He attempted to use the four-line release feature of the parachute but was unable to release the lines. (A subsequent investigation revealed that the chute was properly rigged and that he'd failed to pull the release handles far enough to release the shroud lines.)

Despite a thorough investigation of this mishap, the cause was found to be undetermined. The most probable cause was an erroneous, uncommanded signal to the horizontal stab actuator servo which drove the stabilizer leading edge up. A short or break in the wire (C226A22) running from the air navigation computer to the servo could have caused the kind of erroneous signal that couldn't be countered by applying aft stick.

Two NATOPS procedures were applicable to this mishap. In the procedures for uncontrolled flight: post-stall gyration calls for positively neutralizing controls (an asterisked memorization item) and actuating the AFCS emergency disconnect (non-asterisked). The procedure for runaway trim calls for actuating the AFCS emergency disconnect (asterisked) and pulling the Lat/Long and rudder trim circuit breakers (asterisked). The procedure for runaway trim in NATOPS (but not in the Pilot's Checklist) is prefaced by: "In the event of suspected malfunction or any unusual vibration or oscillation of the flight controls, proceed as follows . . ."

While prompt actuation of the AFCS emergency disconnect probably would have removed the cause of the uncommanded pitchdown, the mishap pilot would have had to have *immediately* concluded the violent pitchdown was precipitated by runaway trim or have memorized the preface to the runaway trim procedure in NATOPS to take the proper course of action.

RAG NATOPS instructors correctly stress the need to study emergency procedures in the NATOPS Flight Manual, since the PCL omits most explanatory discussions. However, this aircrew had less than three seconds to identify a correct course of action to correct an unknown malfunction.

Following this mishap, the squadron submitted an Urgent NATOPS Change Recommendation concerning the "Runaway Trim" and "Uncontrolled Flight/Poststall Gyration" procedures. The changes were incorporated in the revised EA-6B NATOPS Manual and PCL in May 1982.

The Ejection. The three-man crew was ejected when the pilot selected command ejection. Following his ejection, the pilot lost consciousness, but he awoke just as he saw a tree line approaching. He tried to get into a good parachute landing position but passed out a second time. When he came to again, he was dragging his seat pan down a creek bed. He came upon his ECMO-1 on a road. When asked how he was, the ECMO-1 replied that he was OK except for a broken arm.

The ECMO-1 had also passed out after ejecting and gained consciousness on the ground. Looking up, he saw his parachute streamed in front of him over a tree. He attempted to unfasten his Koch fittings but had no success because of his broken arm. After considerable difficulty, he was able to unfasten both his upper and lower Koch fittings. He rendezvoused with the pilot, who had received only minor injuries from the Plexiglas upon ejection. They started out searching for ECMO-2 and found him hanging by his parachute in a tree *about 150 to 200 feet off the ground*. Though he'd received only minor injuries, it took



Weight, Balance, Power Available — Do They All Add Up?

Two CH-53 Sea Stallions are heading for trouble in the following stories. Why? Because the flight crews involved will become so intent on completing their missions that they'll deal carelessly with an important factor — the weight and balance power requirements of their aircraft. One gets treed and the other gets trucked. In each mishap, the old bugaboo, lack of crew coordination, will play an important role. If you're a fixed-winger, stay with us, since the factors leading to these mishaps are universal within naval aviation.

TREED

By Russ Forbush
APPROACH Writer

TWO *Sea Stallions* were scheduled to depart home base, fly to a nearby pickup landing zone (LZ), load 12 passengers and 2,000 pounds of cargo and then deliver the passengers and cargo to an airfield some 145 nm to the northwest.

At 0630, the helicopter crews gathered in the squadron readyroom to receive an operations duty officer brief, a section leader brief and individual crew briefs using NATOPS pocket checklists. When the briefs were over, the two copilots huddled to check NATOPS graphs.

From the graphs, they determined that their aircraft would have 112 percent torque available. They also calculated that at the scheduled takeoff time, with gross weights of 42,000 pounds (max allowable gross weight) each, the *Sea Stallions* would require 80 percent torque to hover in

ground effect (HIGE) at a wheel height of 10 feet above the ground.

The copilots recorded this information on a squadron weight and balance form, asked their HAC to review and sign it, and then filed it with the ODO.

Next, the crews filed the VFR flight plan with base ops, the HACs screened the aircraft logbooks and the crews began their aircraft preflight inspections.

The section leader's aircraft (AA-55) was downed during preflight but because the weather was below VFR minimums, the flight couldn't launch anyway. The crews returned to the readyroom.

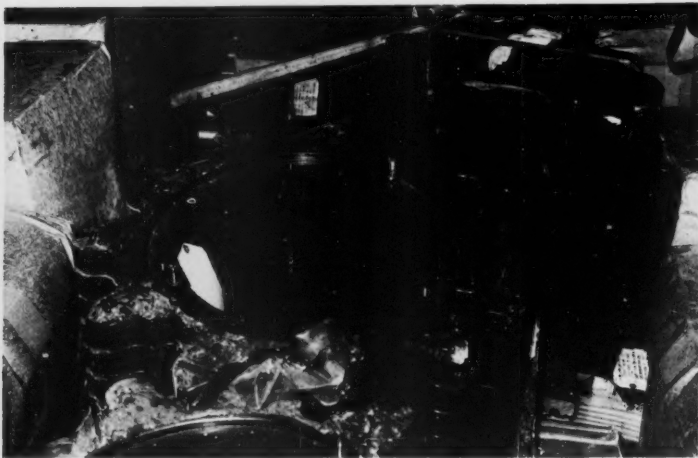
By the time the weather had improved to acceptable conditions, AA-55 was still down. Undaunted, the section leader considered the mission important enough to contact MAG Operations and request permission to send his wingman in AA-60 as a single aircraft. Permission was granted. The section leader intended to join up with AA-60 as soon as he was able to get his aircraft repaired and airborne.

At 0915, AA-60 launched and headed for the pickup LZ. After the short flight and landing, the crew noted that the load staged for transport was considerably larger than the task order had indicated. Nevertheless, they loaded all passengers and cargo aboard the *Sea Stallion*, and the flight to the destination was a piece of cake.

With the passengers and cargo unloaded, the crew gravity refueled the sponson tanks and ate lunch.

Continued

19



The aircraft snagged a support cable stretching across the road and turned or slid to the left along the cable, causing the main rotor blades to strike a power pole. The support cable snapped from the power pole on the east side of the road and whipped to the west, striking the HAC's side window. The window caved in.

At 1345 AA-60 departed for home base where an uneventful landing was made at 1500. The crew pressure refueled their bird, topping off the sponson tanks and adding 2,200 pounds to each auxiliary fuel tank. Ready and heavy, they manned AA-60, started up, engaged, took off and once again headed for the pickup LZ. Arriving, the HAC landed the H-53 on a northerly heading, 340 feet north of the LZ marker and 300 feet south of a tree line which rose to 100 feet.

The crew to be lifted then loaded three pallets of tank sprockets, one pallet of oxygen bottles, a tow cable, three tank torsion bars, eight boxes of sleeping bags, two tank fenders and a pallet of pneumatic truck tires. The pallets of sprockets, two cable and sleeping boxes were clearly marked with their weight. **The weight of all other cargo was estimated.**

The officer in charge of the loading crew guessed that he'd loaded about 7,000 pounds of cargo, while the aircrew figured the weight at 7,200 pounds.

After checking the load tiedown security, the aircrew performed a normal turnup using the NATOPS Pocket Checklist. Before takeoff, the copilot set rotor speed (N_r) at 100 percent.

The HAC then lifted the H-53 about 10 feet above the ground but never established a steady hover. Instead, he immediately transitioned to forward flight and started climbing slowly toward the treeline.

On the way to the treeline, power was 80 percent torque

and 100 percent N_r . As the H-53 moved forward, the HAC eventually realized that his aircraft wouldn't clear the tree-line so he turned right, toward a clearing in the trees. At the beginning of the turn, the copilot noted a very slight decay in N_r , advanced the speed control levers full forward and observed both N_r and torque at 100 percent.

The *Sea Stallion* then flew over a set of 35-foot-high power lines on the east side of the LZ with between 15 and 20 feet of clearance. The HAC was extremely apprehensive as he transmitted, "That's all we've got, we're not going to make it." (At no time during the takeoff did the aircrew consider jettisoning the aux fuel tanks.)

The HAC rolled the H-53 out of the turn heading south with torque at 105 percent and the collective full up. AA-60 had lost altitude and was now flying between the power lines on each side of a road adjacent to the eastern boundary of the LZ. The HAC was desperately trying to gain altitude as his helo lumbered south.

It wasn't to be. The aircraft snagged a support cable stretching across the road and turned or slid to the left along the cable, causing the main rotor blades to strike a power pole. The support cable snapped from the power pole on the east side of the road and whipped to the west, striking the HAC's side window. The window caved in.

The force of the cable slapped the crew chief from his seat to the far side of the cabin. The H-53 was still in a left turn when it struck the ground in a vacant lot adjacent to the road. The tail rotor assembly and tail pylon were torn from



the aircraft by the impact, but the tail skid didn't hit the ground.

The H-53 then bounced back in the air, spun 340 degrees to the right and smacked the ground in a nose-level, left-wing-down attitude. This tore the left main landing gear from its sponson, drove the nose landing gear up and aft through the cockpit flooring and ruptured the left auxiliary fuel tank.

By now, all six main rotor blades were banging away at the ground.

The H-53 was still turning right and rolling left when the copilot pulled the speed control levers to the ground idle detent position. The aircraft came to rest heading 050 degrees in a nose-level, left-wing-down attitude. The crew and passengers didn't wait for the main rotor blades to stop turning before exiting the *Sea Stallion* through the crew door.

Neither the pilot nor the copilot attempted to set the rotor brake or secure the fuel control levers before leaving the aircraft. Both engines were still at ground idle, so the copilot and crew chief reboarded the aircraft and secured the engines using the fuel control in the cabin and then setting both speed control levers to the shutoff position in the cockpit.

Witnesses to the mishap stated that the airspeed of the aircraft never exceeded 20 KIAS. The H-53 was totalled, but no one was injured which, under the circumstances, is hard to believe.

Let's look at the factors leading to this mishap.

The aircrew estimated their cargo lift capability using performance calculations based on the ambient temperature and density altitude which prevailed earlier in the day. These calculations were never updated after the preflight brief.

The NATOPS required 40-foot HIGE (hover in ground effect) computations before flight to provide accurate esti-

mates of power required and power available at both aircraft mission weight and aircraft max gross weight.

The H-53 was carrying about 1,500 more pounds than estimated. Consequently, the HAC took off with a gross weight that was nearly 1,100 pounds heavier than the maximum allowable.

The aircrew didn't comply with NATOPS by placing the speed levers full forward prior to attempting a heavy-load takeoff.

The HAC didn't establish the aircraft in a steady drift-free hover to determine the power required for takeoff.

The HAC should have attempted a running takeoff under conditions of high gross weight and density altitude. Had he air taxied to the southern end of the LZ and transitioned to forward flight at low altitude, he would have been able to take advantage of ground effect and transactional lift. This would have provided a sufficient airspeed and altitude to safely clear the tree line.

The HAC didn't react to the emergency situation correctly. The steep right turn served to reduce the lift factor, causing the H-53 to lose altitude and be unable to continue straight ahead to a possible landing site.

Had the auxiliary fuel tanks been jettisoned, the aircraft would have reduced gross weight by about 5,000 pounds, placing the *Sea Stallion* well within operational weight and balance parameters.

Although the copilot was well aware of what was going on, he didn't question the actions taken by the HAC. This led to a serious breakdown in crew coordination.

The failure of support personnel to accurately weigh and prepare the cargo reduced the margin of safety and adversely affected aircraft performance. Later, the *Sea Stallion* TYCOM instituted corrective action to ensure that in the future all air cargo will be properly weighed, labeled and loaded to preclude the possibility of a similar mishap occurring.

21

TRUCKED

An LPH-based *Sea Stallion* was involved in a rehearsal for an upcoming special exercise. The crew had already logged 4.5 hours of flight time and was now tasked to fly ashore and pick up some cargo.

All concerned hoped that the cargo ashore included a large portion of the squadron's aviation consolidated allowance (AVCAL) which had somehow been lost during the embarkation evolution. Since the mishap HAC was also the squadron's operations officer, he was mighty interested in getting that AVCAL aboard ship.

On the flight ashore, two other CH-53s were to accompany the mishap aircraft and load cargo to be returned to the ship. To do so would require a forklift truck, and since none

was available ashore, the HAC requested that the ship provide one.

Initially, the ship assigned a "4,000-pound" forklift to the mission but then substituted a "6,000-pound" one. The forklift was driven to the HAC's H-53, loaded on board and securely tied down. Later, six passengers and some slings were loaded in the helo.

While loading the forklift on board the H-53, the First Mech noticed weight 10,950 pounds and capacity 6,000 pounds stenciled on the side of the forklift. Although he was apprehensive about the weight he never made it known to the HAC! This was unfortunate in the extreme, since the HAC had observed the 6,000-pound capacity figure and



assumed that was the forklift weight.

The crew manned their aircraft located on Spot 5, went over the appropriate NATOPS checklists, started engines, engaged rotors and received clearance for takeoff. With the speed control levers set for 100 percent N_r , the HAC began to lift the H-53 into a hover.

Five feet above the deck, N_r drooped to 95 percent, prompting the copilot to push the speed control levers full forward. The aircraft began drifting left and settled into the port catwalk.

At this point, the HAC realized he couldn't fly the H-53 off the ship since N_r had now decayed to 90 percent. The left mainmount then struck several liferafts and a speaker located in the catwalk as the HAC eased the *Sea Stallion* forward over the elevator in an attempt to gain additional ground effect. As the main rotor edged over the elevator, additional lift was gained and the HAC then landed the aircraft between Spot 3 and 4. Damage to the aircraft was estimated at over \$95,000.

The same factors as those cited in the first mishap were involved in this mishap. The HAC failed to determine what the actual weight of the forklift was. He saw 6,000 pounds stenciled on the side of the forklift and assumed that was the weight vice the capacity. He estimated his total load at 8,000 pounds, and he assumed a cushion of 2,000 pounds.

When the HAC lifted his helo off the deck, his actual gross weight was well over 42,000 pounds (max gross weight). Had the speed control levers been set full forward prior to takeoff, chances are the mishap could have been avoided.

Again, crew coordination played a factor. The First Mech suspected that the true weight of the forklift truck was 10,950 pounds, but he failed to mention this to the HAC. As a result, the aircraft was 4,950 pounds heavier than expected.

The HAC was intent upon picking up that AVCAL, and this no doubt interfered with his normal alertness. He was considered one of the best, if not the "numero uno" CH-53 pilot in the squadron. Both he and his copilot were highly competent and professional aviators. But, on this particular flight, their professionalism lost some of its gloss. Had they followed NATOPS, the crew would have made the effort to check the true weight of the forklift and computed the takeoff power required for a safe liftoff.

As we said earlier, although these two mishaps involved helicopters, the factors cited could just as easily prevail in the fixed-wing community. Too many people and aircraft have disintegrated over the years because of sloppy weight and balance computations, no computations at all and/or incorrect weights provided by the supported unit.

Weight, balance, operational pressure and the safety of your crew should all add up before you take to the air! ◀

If there is doubt, there is no doubt!

By LT R. R. Wolfe
VT-10

ON a recent cross-country flight in a T-2 to Andrews AFB, we were preparing for our return to NAS Pensacola. Our proposed takeoff time of 0930 local looked good as we checked out of the BOQ, but the rain and wind promised to make the preflight a miserable affair. Checking with Metro, our intermediate fuel stop was IFR and expected to stay that way. Of more concern was the weather at Andrews; 400 overcast and rain, winds 090 degrees at 18 gusting to 24 knots. About this time, two pilots, whose aircraft was parked alongside ours, arrived in Metro. I asked about thunderstorms and icing and was told that a SIGMET had been issued for moderate to severe turbulence from the surface to 10,000 feet. The field was currently under a thunderstorm alert and thunderstorms had been reported in the Norfolk area moving northward with tops to 28,000 and light to moderate icing above 8,000 feet. I then asked about any PIREPS, having a bit of get-home-itis myself, since my daughter's birthday was the next day. A C-141 had reported moderate turbulence in his descent over Richmond all the way down to 2,000 feet. Well, that was enough for me, my get-home-itis had just made a rapid recovery. I looked at the two jocks and remarked that I had heard enough to keep me here for another day. The forecast was to become VFR tomorrow. I was astonished at their reply, "It is just up to the pilot's judgment in these cases, there isn't any Willy-Willy!"

23

If I had doubts as to my aircraft's ability to handle this weather as well as my own, then surely these guys must feel the same, being in a much smaller aircraft (and single engine, too)! I wasn't about to go groping around through IMC conditions hoping not to hit a thunderstorm or icing or both, not to mention that the wind gusts were very near my NATOPS limit of 30 knots at 90 degrees. Aha! My ace in the hole.

I asked the weather guesser what the crosswind component was and his reply was satisfying to me, "It is all crosswind, Sir, 18 knots gusting to 24!" I confronted the other pilots with this. Their reply was predictable, being deeply infected with the I-Gotta-Go-Home-Bug. "Our NATOPS limit is 22 knots at 90 degrees, we can hack it."

Well, short of taking away the keys to their aircraft, I felt I had done what I could to make them see the light. I turned to my XO and stated flatly that we would try it again tomorrow. As we drove away from base operations the XO stated the bottom line, "You know, if those guys make it, which they probably will, they might even scare themselves a little, but this episode will only reinforce their get-home-itis attitude." I was glad at that point to be in a squadron whose motto reads, "Safety First — If there is doubt, there is no doubt!"

LT Brad Goetsch
LT Paul Pompier
VF-11

24

WHILE participating in an overland ACM/EW exercise in an F-14 *Tomcat*, Lieutenants Brad Goetsch and Paul Pompier were attempting a "bug-out" doing .98 Mach at 1,500 feet AGL. In accordance with the Navy Fighter Weapons School ROE for this graduate level exercise, LT Goetsch was executing a 90-degree nose-low defensive turn. As he attempted to unload and roll upright from a near-inverted attitude, he discovered that the control stick would not move either forward or laterally. The aircraft went into an uncontrolled nose-low, high-G turn. LT Goetsch managed to roll the F-14 upright with rudders, whereupon, because of the aft stick position, the aircraft began to loop. At this point LT Goetsch was able to apprise LT Pompier of the situation and have him transmit a "knock it off" call and declare an emergency. While they climbed, the crew prepared for an out-of-control ejection. As the airspeed decreased, the aircraft became controllable. The crew then elected to stay with the aircraft. LT Goetsch slowed the *Tomcat* even further and lowered the landing gear and flaps. In the landing configuration the aircraft was still only marginally controllable. Some lateral stick was available but the stick would not move forward of the six-degree nose-up position, requiring constant S-turns to keep the aircraft from pitching up. LT Goetsch tried once again to free the stick and was now able to obtain a four and one-half degree nose-up stick position. He expertly maneuvered the *Tomcat* to a successful arrested landing at NAF China Lake. A postflight inspection revealed a small aluminum washer jammed in the flight control linkage.

Lieutenant Goetsch's and LT Pompier's professionalism, skill and teamwork saved a valuable asset and led to the discovery of a severe foreign object hazard to F-14 flight controls.




LT Paul Pompier (left),
LT Brad Goetsch (right).

BRAVO ZULU

LT John E. Blasko
ENS Michael Hamele
VT-25

ON 8 February 1983, LT John E. Blasko, instructor, and ENS Michael Hamele, student naval aviator, were Dash 2 in a two-plane TA-4J Air Combat Maneuvering (ACM) sortie. During an engagement, LT Blasko was confronted with a 20-percent oil low light and falling oil pressure. He immediately discontinued the exercise, set 86 percent RPM, turned toward Chase Field and informed his leader of the problem and his intentions. During the descent to home base, the leader joined and confirmed that oil was leaking from the engine access doors above the wing. LT Blasko descended through a hole in the 2,000-foot broken layer to Chase Field and shot a flawless abeam precautionary approach, even though his engine began to surge and trail smoke as he passed through the 90-degree position. Total time from initial indications until the aircraft was safely on deck was less than eight minutes.

Postflight examination revealed that a blown O-ring in the oil filter was the cause of the oil loss. Had flight continued, engine seizure was imminent.

The crew's sharp airmanship and decisive actions were directly responsible for possibly saving an extremely valuable aircraft as well as their own lives. 

25



LT John E. Blasko (right),
ENS Michael Hamele (left).

Double Flameout or How to Ruin a Box Lunch

By LT Gary C. Bowser
HC-6

I WAS eating my apple when it happened — a loud bang aft. At the same time, both engines of our H-46 *Sea Knight* were winding down. The HAC immediately entered an autorotation and turned toward the beach, approximately two miles away. What was going on?

I was the copilot with 60 hours in model, while the HAC had around 13 years flying in the Navy, a mismatch to say the least. We'd just dropped a high-ranking admiral off at a nearby Air Force base and were returning to USS Ship.

Being a good copilot and of obviously lesser rank (LTJG to CDR), I'd flown our aircraft while the commander ate his box lunch first.

After approximately 40 minutes we switched control, and my turn for lunch arrived. The visibility was not very good, and the HAC instructed me to keep a good lookout for other aircraft.

That's when we had our double flameout at 1,100 feet. I quickly forgot about my box lunch.

The HAC asked for power management system off and yelled for a restart. I did the first, but the second command was confusing. I hadn't had a chance to look at the gauges yet and took time now to do so. The engines had indeed quit, and I watched the rotor RPM decrease and stop at around 70 to 80 percent. I took this as a hint and attempted several restarts. The whole event didn't seem real, and how could it? I was just sitting there eating lunch a few seconds ago, right? In 20 to 30 seconds, the aircraft went from 1,100 feet to a splash. Before impact, I looked up from my last engine restart attempt and could see the pilot was well in control of the aircraft. This reduced my worries somewhat.

We hit the water with a little forward airspeed, and I was immediately under water. The aircraft broke apart at station

410 and the aft transmission, blades and engines went their own separate way. The forward section rolled right and became inverted, just barely floating. All inside were now underwater. After the pressure stopped holding me down, I was surprised to find myself still in my seat. I'd felt as if I'd been thrown through the front window. Visibility underwater was near zero. My only thought was to escape.

I found my lap belt easily because I wasn't wearing flight gloves. I removed the gloves, not because this was an over-water flight and I had the option according to 3710.7K, but because I'd been eating lunch 30 seconds earlier and didn't want hydraulic and engine oil mingling with my food.

Before releasing my lap belt, I stopped and remembered that I needed to find a reference point, something I'd remembered from my training in the helo dunker (9D5).

Reaching for the door, I found it wasn't there. I may have released it already, I don't know. That was my last thought before impacting the water. I finally located the door frame with my right hand, released the lap belt with my left hand, and, using both hands, was successful in pulling myself out of the seat and clear of the aircraft.

Swimming toward a light above, I popped to the surface



and found myself bouncing off the aircraft and looking at the nose wheel. I pushed off with my feet and started swimming away (mild panic) while spitting out pieces of the apple I'd been eating for lunch. I checked the pieces carefully, because I first thought I was spitting out my own teeth.

Around 10 feet away from the aircraft, I stopped swimming and my head went underwater. I took this as another big hint and decided to inflate my LPA. One-half worked as advertised; the other did not. The current then pulled me farther away. Two other crewmembers surfaced, but one did not. One crewman swam back to the aircraft to look for the missing man but the current quickly pulled him away. The aircraft was lost, but worse, one life was lost at sea.

Lessons Learned.

- The helo dunker training works. It cannot duplicate the water impact but everything else was very close to the real thing.

- The left set of beads was not pulled on my LPA; my fault, sorry.

- If box lunches are served, make sure one pilot still has control of the aircraft and both are not eating at the same

time. We ate separately; had we not done this, who knows what might have happened.

- I tried to use my PRC-90 and call for help. When the rescue helo arrived, I let go of it and watched it sink from sight. I then remembered three hours earlier when putting the radio in my vest I had told myself, "If I need the radio I'll just tie it on the vest after I get it out." Luckily, I didn't need the radio again, but what if we'd been 20 miles out at sea rather than close to shore and help was not so quick?

The aft section with the engines and aft transmission was not found and no definite cause could be determined. No lesson here.

My attitude about accidents has changed since my mishap. "Why not me?" actually became "me." It would be easy to say "Well I've had mine," and go on, but that would be the easy way out. "Why not me, again?" is possible, but that does not seem original and sounds more like a sequel. The whys will always be there in naval aviation. After all, human and mechanical errors are hard to eliminate completely. Why not do all we can to keep the statistics low? I doubt if the questions will ever end, but hope certainly cannot end as we press toward that zero mishap rate. ◀



Clouds, Mountains, A Green Windscreen

Anonymous Submitted

COASTAL flying. Local weather was special VFR with scud at 400 feet, visibility approximately three miles.

After a standard NATOPS brief and preflight, we left Homefield for a routine VIP pickup. Our squadron was thoroughly acquainted with the local area and the regular VIP passengers.

We kept our helicopter turning at the pickup zone until the aide informed us that the VIP was temporarily delayed. After shutdown, I telephoned base to recheck the weather and was advised of no change except for a little more rain. Considering the low ceiling a definite hazard, I told the aide that the route of flight was to be a circuitous one along the coast, then up to our destination in order to avoid terrain obstacles.

The VIP embarked the aircraft behind schedule and firmly suggested that we take the most direct route to the destination, as he had only 5 to 10 minutes. After contact with Tower, we flew back to the airfield and, after a low approach, departed toward a well-known, low-lying terrain corridor. I pressed on through deteriorating weather, attempting to pass across the lowest terrain. Proceeding up the corridor, terrain elevation increased as

the ceiling decreased. Maintaining VMC became impossible and IMC inevitable.

Having entered the clag to the point of no return, I began a 500 fpm climb at 110 knots, informed my copilot I was on the gauges and attempted a climbout to VFR on top. Seconds later, the *dark green of rising terrain filled my windscreen*. I pulled MAX torque and 40 degrees nose up; by the grace of God, we cleared the terrain by approximately 50 feet.

As my terror subsided, vertigo set in, once to the point of 30-degrees nose low. A horrified copilot shouting, "Pull up! Pull up!" got me back on track. Once established on the gauges again, we contacted approach and followed climbout instructions.

A quick check of our passengers revealed a terrified crew chief and aide, and an (apparently) unconcerned VIP. The sequence of events which followed made us realize the increased severity of our predicament.

We leveled off at 3,000 feet and were

told that our squawk was not being received. Additionally, no local TACANs at nearby airfields were operational at that time. The last transmission we received from Approach was to "Maintain heading..." At this point our "sierra sandwich" became very serious. We had no TACAN, no transponder, no communication and we were in the clag to boot. The only problem we didn't have was fuel. We were well above Bingo. Somehow we found a sucker hole and dropped power for a maximum rate of descent. We recovered the aircraft at 200 feet over the water and saw the faint outline of land on the horizon.

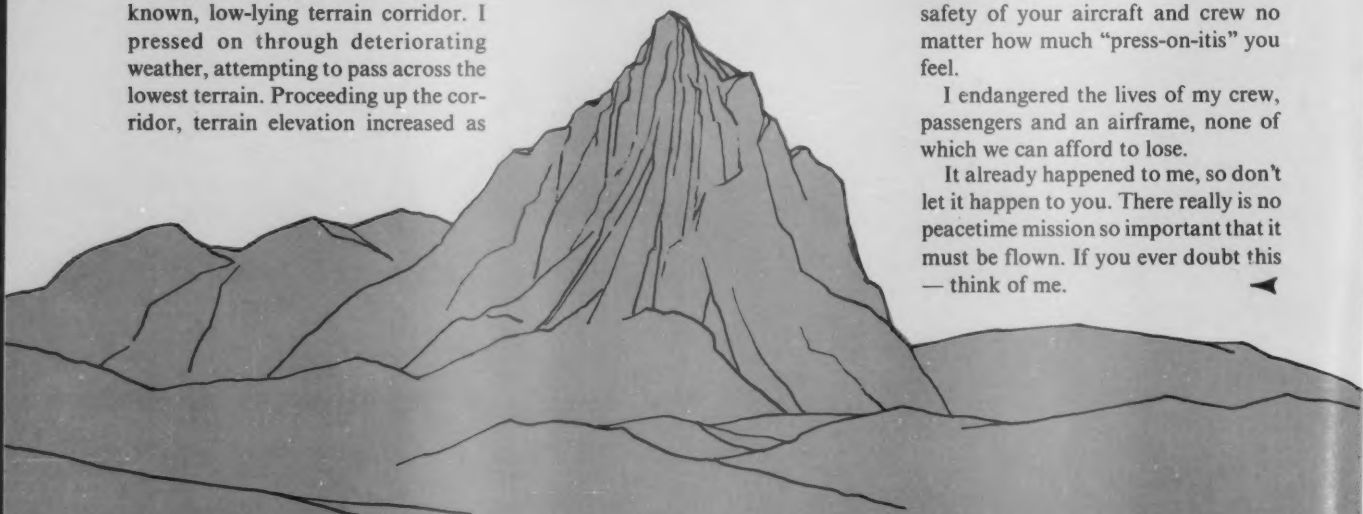
Once within 10 DME of Homefield, we finally were able to regain communications with the tower, and our hop was terminated with an uneventful landing at the VIP's headquarters.

The standard consolation after a "delta sierra" is, "Don't worry, Pal. There are those of us who have and those who will."

Be one of those who will not. That is, one who will not compromise the safety of your aircraft and crew no matter how much "press-on-it-is" you feel.

I endangered the lives of my crew, passengers and an airframe, none of which we can afford to lose.

It already happened to me, so don't let it happen to you. There really is no peacetime mission so important that it must be flown. If you ever doubt this — think of me. ◀



Seconds later, the dark green of rising terrain filled my windscreen...

Toward A Better Safety Program? Quickly — Follow Alice!

By CAPT S. P. Dunlap
Director, Aviation Safety Programs
Naval Safety Center

"Would you tell me, please, which way I ought to walk from here?"

"That depends a good deal on where you want to go," said the cat.

"Don't much care where," said Alice.

"Then it doesn't much matter which way you walk," said the cat.

"So long as I get *somewhere*," Alice added as an explanation.

"Oh, you're sure to do that," said the cat, "if you only walk long enough."¹

29

SAFETY practitioners throughout the world can certainly relate to this exchange between Alice and the Cheshire Cat, for it epitomizes the frustration experienced daily in the broadening field of loss control. We in naval aviation are fortunate in the way we approach safety, for many of the tools required to improve our record are already in place. Necessary assets, such as billets, bodies, schools and dollars are, for the most part, eventually available to further our safety aspirations. If such is the case, *how successful have we really been?*

A simple comparison drawn between the unit cost of aircraft, budget allocations and aircraft losses clearly shows our dilemma. Within the existing fiscal climate, we must continue to lessen our losses or ultimately draw down a segment of our force. Given such an ultimatum, the decision is easy, but the direction is most difficult. Like Alice, we're sure to receive *some* sort of result, so long as we do *something*. The results recently achieved, although certainly positive, have only been modestly successful; thus we may conclude that a shift in the direction of our corporate naval aviation safety program is in order.

With respect to aircraft mishaps, in no other area of safety has our frustration been more apparent than in the field of **pilot error**. A cursory examination of 20 years of statistical data shows that although the total number of mishaps has decreased, the percentage of all Class A (major) aircraft

mishaps credited to pilot error has remained generally constant. Since naval aviation history tells us that our greatest safety problem has been pilot error, why haven't we been more successful in improving this consistent source of major loss?

I submit that a great part of the problem stems from the fact that safety is viewed as an occupation rather than a profession. While an occupation is any activity in which one engages, a profession is founded upon an understanding of the theoretical structure of some department of learning or science, i.e. a factual base. In the field of safety, much of what we believe is predicated upon what we've been taught. Typically, therefore, many of us cling steadfastly to the notion that "accidents are caused by unsafe acts and/or conditions." Such a theory was formalized in 1931 by H. W. Heinrich and came to be generally accepted despite a lack of proof or data to substantiate it.² Adherents to this model of accident causation typically trace any mishap back to the person(s) responsible for the unsafe act/condition, then attempt to resolve the problem through resolution of human error (improved training, screening, supervision, etc.) and environmental conditions (better lighting, machine guards, temperature control, etc.).

Naval aviation has seen numerous such advances, many brought about specifically to stem the tide of aircraft mishaps. Transitions from paddles through the mirror to the

lens, or black decks through red decks to white floods, have been made with demonstrable success. Indeed, statisticians may justifiably depict the positive effect which improvements such as NATOPS, CCA, the droplight, or sequenced strobe lighting have had on naval aviation safety, and it's clear that each of these major improvements was undertaken to address either unsafe actions or conditions. Unfortunately, no proof exists to validate H. W. Heinrich's academic theories. Although there can be no doubt as to the effectiveness of the improvements which have been made, systems and management analysts now believe that our penchant for "finding the guilty party" (i.e., proving pilot error) has reinforced a very basic misconception.

They suggest that we have done some very fine things, yielding some very positive results, for what may well be incorrect reasons. We've received some sort of result merely because we've done something.

Improvement in the safety record of naval aviation is not just desirable; it is a fiscal imperative which demands that we examine in detail the basic philosophy underlying any long-standing safety program. It cannot be enough to wait until a mishap has occurred, investigate it and specify those personnel or conditions "most responsible." Actions must, whenever possible, be taken *before the fact* to preclude the loss of an airframe with a total cost that might exceed the lifetime earnings of 50 Americans. Such a safety program is neither revolutionary nor difficult to understand. Philosophically, however, it requires a transition from a program founded on opinion to one based upon long-recognized principles of sound management and systems analysis.

To support such a supposition, we need look no further than the definition of the Navy management program which "is built on the premise that deep-seated and recurring problems are usually systemic, representing a failure of a more fundamental management process. The program treats problems as symptoms and tries to understand them within the context of the Navy's formal and informal management systems."³

Similarly, the premise that deep-seated and recurring problems in aviation safety are usually systemic has identical validity. Repetitious problems leading to aircraft mishaps are indicative of a flawed management process. The problems of business, whether they relate to personnel, procurement, finance, quality assurance or safety, will respond most effectively to the timely and intelligent application of the principles of sound management.


Is safe performance *really* one of the desired products of an activity? If so, then within the established managerial routine of planning, organizing, staffing, directing, coordinating, reporting and budgeting,⁴ a demonstrated lack of safety must be viewed as an "operational error" (mishap). Once this reorientation of managerial thought takes place, it will become readily apparent that an operational error is the end result of either a poor decision within the chain or a risk which was deemed acceptable. The difference in outlook is quite clear; a technician will reason objectively why people

make mistakes, while the manager reasons subjectively why the elements of management fail, allowing for the imperfect performance of people. Viewed in such a manner, the performance imperfections of the individual, while certainly a problem for the immediate supervisor, are also symptomatic of a systems deficiency. **The correction of a single person because of a safety violation will do little to improve problems generated by managerial oversights.**

Years of mishap investigation within naval aviation have yielded positive results which are indeed laudable. Unfortunately, our collective obsession with the assignment of mishap fault to personnel has not been so successful — and for a very good reason. A mishap is nothing more than a symptom of functional unreliability. Unflawed performance, therefore, is the vital link connecting mishap prevention to improve operational readiness.

To paraphrase Peter Drucker, there are three functions of management within naval aviation which every participant must understand:

- successful naval management must always, in every decision and action, put operational readiness first.
- successful naval management must sponsor and engender an atmosphere of error-free performance within the framework of risk analysis.
- successful naval managers must manage both personnel and their work.⁵

The problem of improvement in naval aviation safety is both complex and multifaceted. Certainly we've been successful in improving the record. The decrease in total mishaps has occurred as a result of direct attention and improvement in many areas. Unfortunately, past improvements have largely come in response to obvious problems with obvious solutions. *To a great degree we've run out of both cheap and easy fixes; if we require an improved mishap rate and fewer pilot errors, we must be willing to pay the price. We need a new and specific direction.* This "new direction" is neither new nor revolutionary, but it does require reorientation of thought at every level within the Navy in order to be successfully implemented. The genesis of such change may be found in any graduate-level text on improvement in management practices and demands neither great intellect nor tremendous expense, only dedication and an ordered approach to the universal problem of performance improvement. 

Presently serving as the Naval Safety Center's Director of Aviation Safety, Captain Dunlap has held more safety-related billets than any officer in the Navy. A prolific author and lecturer in the field of Loss Control and Risk Analysis, he holds an MS in Safety and Systems Analysis and is a doctoral candidate in the field.

References (as listed in the text)

1. Carroll, Lewis, "Alice In Wonderland," Peter Pauper Press, Mount Vernon, 1954.
2. Heinrich, H. Petersen, D. and Roos, N., "Industrial Accident Prevention," 5th Ed., McGraw-Hill, New York, 1980.
3. Center for Naval Analysis Progress Report on The Naval Management Program, 1982.
4. Gulick, Luther, "The Elements of Administration," Institute of Public Administration, New York, 1937.
5. Drucker, P., "The Practice of Management," Harper and Row, New York, 1954.

Tomorrow May Be Too Late!

By LCDR Tom Sobieck
VF-1

THE 61st day in the Indian Ocean . . .

It's 0330, and you've got the four o'clock alert. That darn schedules officer stuck it to you again. Well, you'd better get down there and relieve old LCDR Personality on time or he'll wade around in your mess kit and tell Ops you've done it again. Rats! I left the Africa flight pubs on my desk. Oh well, you're working blue water ops anyway. You must be losing some weight — the G suit's loose and the harness isn't nearly as uncomfortable as it was when you left the States. One of these days you're going to get all your flight gear squared away, right? Hope the SDO got the brief. The weather never changes, anyway. They'll tell you everything you need on Button 8 in the remote chance that you get launched. Better hurry. LCDR Personality is waiting. No time to read the book. Just flip through it so the maintenance chief won't snitch on you if something goes wrong.

It's sure dark out here. Where the heck is your flashlight? There it is, just as dim as it was last time. You were going to change the batteries in it back in April — this is July. There it is, 33 tons of fighter, and you know it like the back of your hand. If you don't take time to preflight, you'll avoid the embarrassment of asking a plane captain for his flashlight and you'll be right on time so Mr. Personality can't complain. Besides, he always does a thorough preflight.

Well, here you are. Ready to relieve. Better climb in and start getting comfortable. The next two hours are going to be a real borex, and the guy scheduled to relieve you is always late. Maybe you can get comfortable enough to catch a little combat nap. Let's see, if you just run the rudders or the foot pedals all the way down . . . Oh, that's better. Do you think Mr. Personality pulled the pins in the canopy? Sure he did. He always does a thorough preflight.

What's all that noise? We're launching? Good, that means you'll be one up on the XO. OK, OBC's (onboard checkout's) running, the alignment is started. What else is there to do? The ordies want to arm the tanks. OK, OBC's done, the alignment's ready. There are those CIA, CPA, CPB acronyms. Isn't there something you're supposed to remember about them? No time now. You've got to beat Brand X to the cat. Hey slick, you'd better do a takeoff checklist. Oh yeah. Brakes, fuel, canopy, seat (boy, I hope Mr. Personality looked this over), stab aug, CBs (circuit breakers — he left a bunch of them out. I'd better reset 'em. Wasn't there something about those acronyms and CBs?) No time now — they're breaking Brand X down. Checklist complete, you think.

You're winning the race. They're stopping Brand X for his hook check. They haven't given you one yet, but you flew this bird yesterday and the hook worked just fine. OK, roger 66,000 pounds. Wings are coming out, flaps and slats are down, trim for a burner go. All right. The yellow shirts have


you in tension. The engines look good, no lights. Sticks coming to the left. Hey, there are no outboard spoilers. Darn, it's the circuit breaker. Mr. Personality left that one out too, and it's so hard to turn around and check it when you're in a hurry. OK, stick to the left, right, aft, rudders. Cat officer's got you now, waiting on burner. There's the five fingers. Light 'em up. The nozzles work good. Let's go.

Don't you just love the cat shot? What's our vector? Come on, you guys, talk to me. You're passing 5,000 feet and still Popeye. How come the SDO didn't tell you about the weather? Have you got the missiles prepped yet? What do they mean RTB? You just got airborne. They obviously don't have the big picture. The cutting edge of the sword is out here and they want you to RTB. OK, OK, life is one big practice session!!

You're in Marshal, the checklist is done and you've got your push time. What's that MASTER CAUTION light on for? Hydraulic light, huh. Combined system is going down. Where's that pocket checklist? OK, let's be cool about this. Go through the procedures just like they're written. Maybe you'd better tell someone down there. That way they can take Brand X first and you won't foul the deck for him. Yep, you'd better do that.

Approach speeds going to be how much faster? How long until the deck's ready? Boy, you should have asked for a hook check. You'd feel a lot better now if you had.

It's push time and you're still heavy, so you'd better start dumping. OK, dumps on. What was the final bearing? Why can't it be VFR today? You're dirty now except for the speed brakes. Can't put them out while you're dumping fuel. Fuel, fuel — my God, the dump's still on! 4.0, huh? Better make this first one a "full stop." Three-quarter mile, call the ball. Try to sound nervous when you tell them your fuel state. "101, *Tomcat*, ball, 4.0." "Roger ball" — now just do what paddles tells you and everything will be fine. Keep it in the middle now. Lineup's squared away. Oops, it's starting to settle a little, but you've almost got the ramp made. Maybe if you just kind of "finesse" it. What a way to stop an airplane. Well, CNO wouldn't have put a one wire there if he didn't want someone to snag it every now and then. Here comes the tow tractor. You're heroes; or are you?

There are several mistakes illustrated by this hypothetical story. Some are embarrassing, some are dangerous and some could have been fatal — all have happened before. One of our greatest enemies is our penchant for taking things for granted. The easy way out becomes most tempting during the midst of a deployment when even the ultimate challenges of blue water operations become routine. Does the person described in this article resemble you in any way? If he does, now's the time to pull up short and get with the program — **tomorrow may be too late!** 

LETTERS

Re: "The Final Approach (April 1983)"

Virginia Beach, VA — I don't know what Grandpaw Pettibone is going to do with the likes of the article written so adroitly by your staff writer, Mr. Richard A. Eldridge, but I'd venture to say it's going to be a beaut! Those of us who have been, or are in, naval aviation have witnessed many such incidents over the years, but after perusing this one over and over again, I for one must say that this is a classic, bar none.

From the article I gather that the ill-fated pilot was below average in flight training, in the RAG as well as in the squadron. He was observed by no fewer than three COs, a flight surgeon, LSOs and several peers as having problems of a deep and serious nature. Many flight boards and reflyies obviously dotted his record of training. Yet no one in authority had the sound judgment, common sense or plain guts to step forward and ask the shaky pilot to toss in his wings before he killed someone (in this case, himself).

So, the *elementary mistake* referred to in the text of the article was not limited to the maneuver that allegedly caused the crash; it was also the *elementary mistake* of those in authority (primarily the COs involved) who neglected their duties of professional leadership through learning and experience by allowing things to go too far, leading eventually to the pilot's *final approach*!

Joe Homer
Major USMC(Ret)

Hang Gliders or Ultralights?

Medford, Oregon — I was given a copy of *APPROACH* (October 1982) where your inside front cover story says the "light aircraft (that got in the way of an F-14/A-6 formation of two) were ultralights and hang gliders."

As I'm sure you know, ultralights and hang gliders are two entirely different aviation species, much as F-14s and sailplanes are not exactly the same type of aircraft. I am sure that you would agree with the obvious differences between the sailplane and the F-14.

Many people, however, including those in aviation circles, continue to lump hang gliders and powered ultralights in the same category. This has led to considerable "bad press" for hang gliders that have been accused of air space violations when it was, indeed, powered ultralights that were responsible.

It is very important to the U.S.H.G.A. that this distinction be maintained, and the reason for my letter is to inquire whether the incident you quote did, indeed, involve hang gliders or

whether the light aircraft referred to were, in fact, powered ultralights. If it has a motor, it is a powered ultralight. If it has no motor, then it's a hang glider.

I would appreciate your clarification of the incident that you describe since I have a great interest in the area of hang glider airspace violations.

Awaiting your response.

I remain,

Doug Hildreth
Chairman, Accident Review
United States Hang Gliding Association

• The hazard report we received identifies the light aviation species involved as "hang gliders or ultralights." Unfortunately, things were happening very quickly and the fliers of the brightly-colored craft did not report to the aerodrome of the FAA for a post-hazard interview. We appreciate your interest in safety and consider it an extremely encouraging sign that the U.S.H.G.A. is concerned to this degree with the proper use of airspace. The purpose of the story was to heighten the awareness of the restrictions inherent in flying in controlled airspace, not to blame a certain strata of fliers. So long as pilots obey the rules, there's safe room for all.

Real Aviators

Norfolk, VA — "Real Aviators Don't Read NATOPS" in your January '83 issue was super. It brought forth more comments than any other article you've published (from statements that I heard).

The purpose of publishing an article or magazine is to get information to the reader. A well-written article that no one reads defeats itself. This article was not only well-written and particularly timely, it was well-read. It got the message across! My compliments to the author for his ingenuity and my compliments to *APPROACH* for publishing it.

Jeri Colenda
NARF Norfolk

In Search of Downed Airplanes

Pensacola, FL — Following a recent search for a downed aircraft, the Aircraft Mishap Board involved was unaware of the availability of radar scans from Air Traffic Control to help in locating the wreckage. The Civil Air Patrol, Army National Guard and Reserves searched for three days until they finally found it.

This time was wasted because ATC had the aircraft on its radar scan and tracked to within 300 yards of its final position, but neither the

AMB nor any other components at the site of the wreckage knew of the ATC capability to locate the plane.

As a representative of the AMB (and following the advice of the TYCOM endorsement), I suggest that the Naval Safety Center educate, through its various publications, the Navy's ASOs as to the availability of ATC radar scans in locating downed airplanes.

D. J. Lingle
Air Operations Department
NAS Pensacola

• Events of the subject mishap emphasized the importance of using Air Route Traffic Control Centers (ARTCCs) for the rapid location of crash sites. Computer-generated flight following, even for VFR flight plans that don't request flight following, is available in most areas of the U.S. when takeoff time is supplied. — Ed.

Falkland Islands Lesson

Santa Ana, CA — Aboard ship during the Falkland Islands War, the British provided their crewmembers with burn-protective clothing to be worn during General Quarters. This consisted of a white cotton hood and gloves similar to those worn by large caliber gun layers for flash protection. Pilots not flying at the time wear this gear with their *Nomex* flight suits.

A similar type of protective hood made of *Nomex* is also worn by civilian racing car drivers.

Is there any effort in progress to provide this type of protection to U.S. Navy and Marine Corps personnel aboard ship to wear during General Quarters?

Col H. M. Whitfield, USMC
Marine Wing Support Group 37
MCAS El Toro, CA

• *Nomex* coveralls are currently issued to engineering and hot-space personnel fleetwide to protect against burns. Additionally, Mr. William Furchak of NAVSEASYSOM tells us that head-to-toe fire protection clothing has been under study experimentally for approximately three years; it will probably be ready for fleet issue by FY-85 for all shipboard personnel.

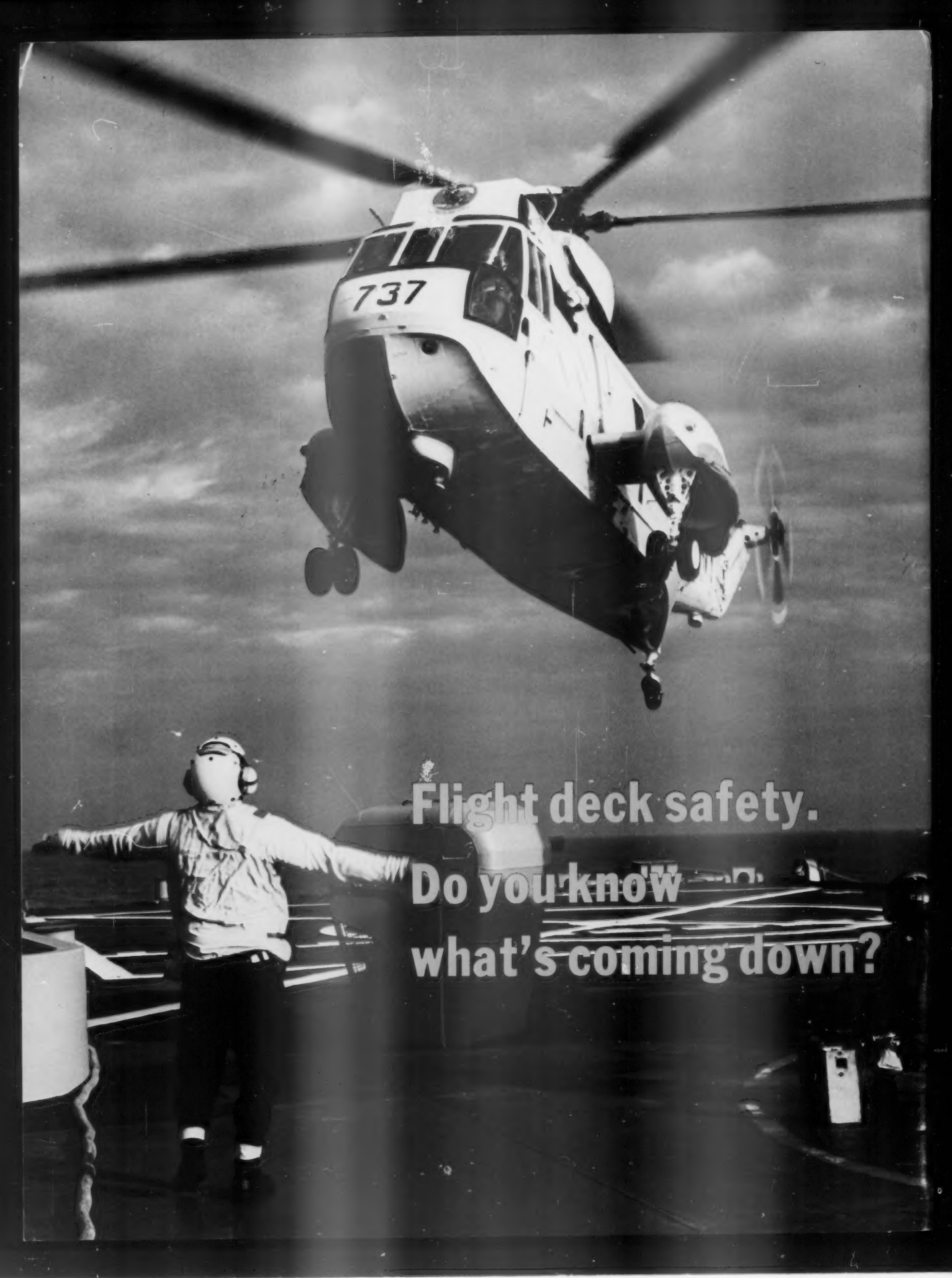
APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: *APPROACH* Editor, Naval Safety Center, NAS Norfolk, VA 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

COMING YOUR WAY



McDonnell-Douglas

The AV-8B Harrier II will begin replacing the AV-8A this November when the first of 12 pilot production models is delivered to VMAT-203 at MCAS Cherry Point, N. C. The "B" is an evolutionary improvement over the "A," and in our November '83 issue, we'll be discussing technological advancements in the Harrier II that significantly increase readiness, performance and safety.



Flight deck safety.

**Do you know
what's coming down?**

